

Isoscalar Spin Response in the Continuum Studied Via the $^{12}\text{C}(\vec{d}, \vec{d}')$ Reaction at 270 MeV

Y. Satou^a, S. Ishida^b, H. Sakai^{a,c}, H. Okamura^d, N. Sakamoto^b, T. Uesaka^d, A. Tamii^c,
T. Wakasa^e, T. Ohnishi^b, K. Sekiguchi^b, K. Yako^a, K. Suda^d, M. Hatano^c, H. Kato^c, Y. Maeda^c
and T. Ichihara^b

^a Center for Nuclear Study, University of Tokyo, Tokyo 113-0033, Japan

^b The Institute of Physical and Chemical Research (RIKEN), Saitama 351-0198, Japan

^c Department of Physics, University of Tokyo, Tokyo 113-0033, Japan

^d Department of Physics, Saitama University, Saitama 338-8570, Japan

^e Research Center for Nucleon Physics (RCNP), Osaka 567-0047, Japan

E-mail: ysatou@rarfaxp.riken.go.jp

Studies of spin-flip scattering of deuterons off nuclei, i.e., the (\vec{d}, \vec{d}') reaction, constitute an important extension to corresponding studies using the (\vec{p}, \vec{p}') reaction. A new aspect in the (\vec{d}, \vec{d}') reaction is the selective excitation of isoscalar $\Delta T = 0$ transitions as required by the isospin conservation. This, together with the availability of spin observables, enables us to study isoscalar spin excitations in nuclei using this reaction. Relatively little information is available for this class of nuclear excitations up to now. Another interesting aspect of this reaction stems from the spin-1 nature of the deuteron: the reaction can be used, again by making use of spin observables, as a probe of double-spin-flip excitations, such as the proposed double Gamow-Teller states [1].

In a previous work, we have demonstrated the experimental capability of measuring deuteron single- and double-spin-flip probabilities S_1 and S_2 through direct observation of polarization transfer over a wide excitation energy (Σ_x) range [2]. By examining spin-flip spectra, obtained for ^{12}C below $\Sigma_x = 24$ MeV, the usefulness of S_1 in identifying isoscalar spin-flip states was shown, along with the potential capability of S_2 to detect double-spin-flip states.

Recently, we have extended the measurement to higher excitation energies up to $\Sigma_x \approx 58$ MeV in ^{12}C in search of isoscalar single- and double-spin-flip strengths in the continuum. The measurement was performed at RIKEN Accelerator Research Facility (RARF) using the 270 MeV vector and tensor polarized deuteron beams from the K = 540 Ring Cyclotron and the SMART spectrometer. The polarization of scattered deuterons was determined with the focal plane deuteron polarimeter DPOL [3]. The angular range covered by the present experiment was $\theta_{\text{lab}} = 2.5^\circ$ – 7.5° . We will report the new spin-flip data. Implications on the isoscalar spin responses in the continuum will also be discussed.

References

1. N. Auerbach, L. Zamick and D. C. Zheng, Ann. Phys. 192 (1989) 77.
2. Y. Satou et al., Phys. Lett. B 521 (2001) 153.
3. H. Kato et al., AIP Conf Proc. 570 (2001) 770.